USAARL Report No. 94-10

Technical Evaluation of the UH-60Q Aircraft in Typical Aeromedical Evacuation Missions

By

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and

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Aircrew Protection Division

February 1994

United States Army Aeromedical Research Laboratory
Fort Rucker, Alabama 36362-0577

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The UH-60Q prototype MEDEVAC Black Hawk is configured to provide day/night, adverse weather, emergency movement of patients. The objective of this report is to describe the ability of the prototype aircraft to perform typical aeromedical evacuation missions. The prototype aircraft with typical crew performed five simulated day and night medical evacuation missions as described in the Materiel Need Statement for the Dustoff UH-60Q. Medical aidmen and aviators rated the medical interior and avionics systems and provided comments on their in-flight experiences. The prototype UH-60Q Black Hawk is capable of performing the typical MEDEVAC missions. Nondevelopmental components of the medical interior require some refinements including improved vertical clearance for litters, improved durability, and environmental tolerance. Communications and cabin lighting. require additional study to refine these requirements.

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Introduction

The UH-60Q prototype MEDEVAC Black Hawk is configured to provide day/night, adverse weather, emergency movement of patients. The Materiel Need Statement for the UH-60Q directs that the aircraft be capable of performing medical evacuation in several mission profiles (Department of the Army, 1992). These include Southwest Asia, Europe, MAST, and Persian Gulf scenarios that are summarized in Appendix A. The U.S. Army Aeromedical Research Laboratory (USAARL) was tasked by the Utility Helicopter Program Manager to evaluate the UH-60Q aircraft in flights that simulate the typical mission profiles. This information is needed to determine functional requirements for future operational and user tests of the UH-60Q. This report details the results of technical evaluations of the medical systems onboard the UH-60Q aircraft during simulated MEDEVAC missions. An analysis of individual components of the medical interior, including the litter lift system, medical suction system, medical oxygen system, external rescue hoist, and cargo loadmeter are described in more detail in separate reports.

The prototype UH-60, serial number 86-24560, is configured as the Proof of Principle Aircraft YUH-60A(Q). This helicopter (shown in Figure 1) is equipped with an enhanced medical interior, enhanced avionics and visual displays (Figure 2), and an externally-mounted rescue hoist.

The objective of this report is to assess the performance of the UH-60Q MEDEVAC aircraft in performing typical medical evacuation missions. This information will be useful to the Utility Helicopter Project Manager when evaluating how each component of the medical interior enhances or degrades the ability of a UH-60Q to perform the MEDEVAC mission. This work was completed at the request of the UH-60 Project Manager to support the development of the aircraft.

Materials and methods

This evaluation was conducted in October and November 1993 within designated test flight areas in and around Fort Rucker, Alabama, using facilities and resources available to USAARL and included a flight to Lexington, Kentucky. The UH-60Q Black Hawk S/N 86-24560 is configured as the Proof of Principle Aircraft YUH-60A(Q). Twenty flight hours were required to complete evaluation of the UH-60Q in typical aeromedical evacuation mission profiles.

The five simulated evacuation missions flown during the evaluation included day and night Southwest Asia missions, day and night MAST missions, and a day Persian Gulf mission. Each mission was flown with a typical crew of two pilots, a medical aidman acting as the medical aidman, and a second medical aidman performing the duties of the crew chief.

Figure 1. Overview of the prototype UH-60Q aircraft.

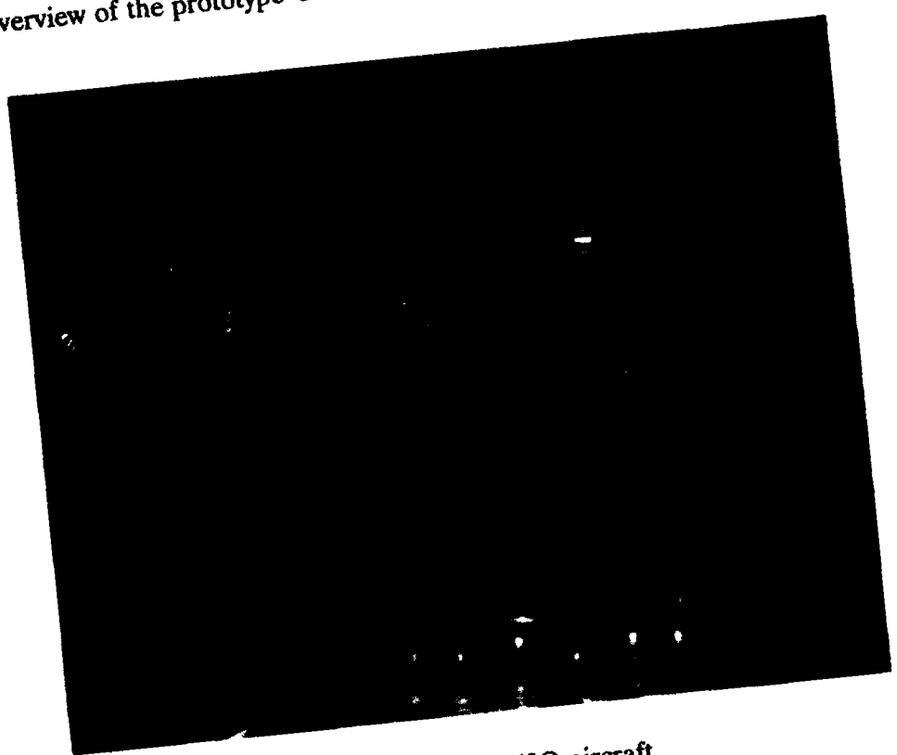

Figure 2. Instrument panel in the prototype UH-60Q aircraft.

The data collected included: acceptance inspection, physical characteristics of the aircraft systems, and survey responses of the pilot-in-command, medical aidmen, and flight surgeons. For each mission flight, aircraft performance (including airspeed, fuel consumption, and mission time), systems used to complete the mission, and barriers to completing the mission were evaluated.

Personnel on each flight included two rated aviators, a medical aidman acting in his duty position, and a second aidman acting as the crew chief. A U.S. Army flight surgeon observed the conduct of each test flight. Patients and medical teams were simulated with observer personnel and manikins. On each of the MAST missions, a flight surgeon filled the role of physician as designated in the mission scenario and completed a questionnaire on the medical interior.

Pilots for the study were current in the UH-60 and trained in the use of the special systems in the prototype UH-60Q. The medical aidmen were trained in the 91B military occupation specialty and completed the flight medical aidman course for the "F" special skill identifier. Three of the five medical aidmen are instructors in the "F" course at the U.S. Army School of Aviation Medicine. The medical aidmen were provided 2 days of training to familiarize themselves with the special equipment on the aircraft and to devise procedures for completing the simulated evacuation missions. The procedures and instruction were observed by instructors from the School of Aviation Medicine to assure that they conformed with current procedures and were within the scope of training of the medical aidman (where applicable). All of the flights were conducted within the scope of a special airworthiness release issued for the evaluation (Appendix C).

After each evaluation flight, the two medical aidmen and an aviator completed questionnaires on the systems used during the flight. They were asked to rate the system (if used) on a scale where 1 = poor, 2 = fair, 3 = satisfactory, 4 = good, and 5 = excellent. The questionnaires also encouraged the respondents to describe how the system enhanced or degraded their ability to perform the mission.

Several systems on the aircraft had not undergone flight testing and could not be operated on the prototype aircraft during these evaluation flights. The medical interior, including the litter lifts, medical oxygen system, and medical suction system were not operated while in flight. All loading and positioning of the litter lifts were completed with the aircraft on the ground. Likewise, the environmental control unit was not operated, the center intercom (1 of 3 in the crew cabin) was inoperative, the private mode on another intercom was inoperative, and blackout curtains were not available.

Results

The physical characteristics of the litter lift system, medical oxygen system, medical suction system are detailed in separate reports (Bruckart and Licina, 1993a; Bruckart Licina, and Quattlebaum, 1993a; Bruckart, Licina, and Quattlebaum, 1993b). Performance demonstrations of the external rescue hoist and cargo loadmeter system are described in a separate report (Bruckart and Licina, 1993b).

Southwest Asia missions

Four questionnaires were completed by the medical aidmen performing the day and night Southwest Asia mission scenario. The overall ratings for selected medical interior systems are shown in Table 1.

Table 1.
Results of four questionnaires on selected medical interior systems from Southwest Asia day (D) and night (N) missions.

System	Not Rated	Poor	Fair	Satisfactory	Good	Outstanding
Litter lift			D,N	D,N		
Suction	D,D,N,N					
Oxygen	D,D,N,N					
Tencate window	N		D			D,N
Communications		N		N	D	D
Crew seats	N				D	D

The specific written comments provided by each survey participant are contained in Appendix C.

MAST missions

Four questionnaires (3 day and 1 night) were completed by the medical aidmen and a flight surgeon following the day and night MAST mission scenario. The overall ratings for selected medical interior systems are shown in Table 2.

Table 2.
Results of four questionnaires on selected medical interior systems from MAST day (D) and night (N) missions.

System	Not Rated	Poor	Fair	Satisfactory	Good	Outstanding
Litter lift				D, D	D, N	
Suction	D, D, N			D		
Oxygen	D, D, N					D
Tencate window	D, D, N				D	
Communications			D	D, N	D	
Crew seats				D, N	D	D

The specific written comments provided by each survey participant are contained in Appendix D.

A questionnaire was not completed by the single medical aidman on the Persian Gulf mission scenario. This individual had previously completed two questionnaires and did not feel that he could provide additional information after flying this mission.

Pilot surveys

Three surveys were returned by aviators for the mission flights. These included the night Southwest Asia and day and night MAST missions. The details on the mission times, fuel load, fuel used, and passenger load are shown in Table 3.

The following systems were used to complete the mission flights: UHF radio, VHF radio, FM radio, inertial navigation system, global positioning system, Doppler velocity sensor, ADF, FLIR, Stormscope, weather radar, and multifunction display unit. Each of these was rated outstanding by the aviators. Detailed comments from the aviators are included as Appendix E.

Table 3.
Mission duration, take-off weight, fuel load, fuel used, air temperature, and number of persons on aircraft for evaluation missions.

Mission	Mission duration	T/O weight (lbs)	Fuel load (lbs)	Fuel used (lbs)	Outside air temp. (C)	Persons on aircraft
SW Asia (night)	1:45	19,800	1550 main 650 external	1400	+16	9
MAST (day)	2:17	not given	2020 main 540 external	1660	+15	7/9
MAST (night)	1:47	19,500	1750 main*	1850	+17	7/9

*Information on external stores fuel load not given.

Discussion

The prototype UH-60Q MEDEVAC aircraft is capable of performing the typical missions described in Appendix 1 of the Materiel Need document for the UH-60 (1992). The flights flown for this evaluation included the first night vision goggle flights, first external hoist loading, and first external cargo loading for the aircraft. Each of these missions was completed without problems. The aviators flying the aircraft for these missions described significant improvements in communication and navigation from the avionics enhancements in the aircraft.

There were no defined procedures or manuals available for operating most of the systems on the prototype aircraft. Therefore, procedures, manuals, maintenance, and training were not assessed in this evaluation. New procedures developed during this evaluation are described in reports.

The litter lift system was rated fair to satisfactory in the evaluation. The problems encountered included lack of vertical clearance, concern for the lack of a mechanical backup, difficulty locating the litter straps, and difficulty loading past the middle crew seat. These issues are further addressed in a separate report (Bruckart and Licina, 1994a). A new problem identified in this evaluation was the presence of a reflective paint on the litter lifts. The semigloss gray-white paint did not cause problems on day flights, but the cockpit lights are reflected on the side of the lifts, particularly when viewed with night vision goggles. A darker color paint with a flat finish should be used on the litter lifts.

The medical suction and oxygen systems were not used in flight in accordance with the airworthiness release. The performance of these systems is described in separate reports (Bruckart, Licina, and Quattlebaum, 1994a and 1994b).

The Tencate (bubble) window was praised for improving visibility of the tail area. However, an individual seated in the crew seat is not able to see out of the "bubble" portion of the window without removing the upper body restraints. Several participants also complained of visual distortion from the window. Distortion is in the area where there is a rapid change in radius to accommodate the bubble shape. It is much worse with night vision goggles where the field-of-view is limited and spurious reflected lights can be disorienting. An alternative would be to replace this with a window that bows outward with a constant curvature. Additional benefit would be gained by adding a vent to one of the cabin windows to allow airflow in the cabin area when the environmental control unit is not operating.

A significant concern for the medical crew is the lack of storage space in the prototype aircraft. The new environmental control unit displaces some storage space for aircraft equipment, such as cowl plugs, and they must be stored in the cabin area. Likewise, there is no provision for survival kits, medical kits, or personal gear. The current medical cabinet is inefficient for storing medical kits and not sufficiently durable for operational service (a drawer already was broken on the unit). The medical aidmen said that they prefer to keep their equipment in kits that can be easily removed from the aircraft for security and restocking. They suggested replacing the medical cabinet with shelves for medical kits and hooks for stowing the survival kits and helmet bags on the outside. Additional flexibility and space can be gained by providing a means to stow cargo on the litter pans when not used for patient transport.

The nondevelopmental components in the medical interior need to be compatible with the harsh environments of military service. Electrical outlets and switch contacts do appear to provide sufficient protection from dust, sand, and rain. Failure of these components in service will deteriorate the capability of the aircraft to perform the mission. The most serious omission identified by the evaluators is the absence of a mechanical backup to allow use of the litter racks if the lift mechanism fails. The medical aidmen said that the "hand rail" is not sufficiently durable for long-term service and adds no significant benefit. IV hooks can be added to the top of the litter lifts and the "hand rail" eliminated.

The MAST mission scenario requires that five persons (medical aidman, crewchief, Doctor, and two nurses) be able to communicate while providing medical care in the aircraft. Communication was limited in our tests by an inoperative intercom and inoperative private circuit in one of the two functioning intercoms. The presence of a VOX circuit allowed hands-off communication, but could not be used when the aircraft doors are open. A key issue is how to communicate two channels of critical information (flight and medical in this case) which are interrelated and are restricted to one or two channels. The private and VOX circuits promise to enhance the capability to communicate in the UH-60Q, but additional research is

needed to properly define the methods required for a large group to engage in critical communications in this restricted environment.

The crew seats were described as more comfortable and able to provide immediate access to the patients. However, each respondent felt that some medical procedures, particularly for the upper and bottom litter patients, will require them to leave their seats. The center crew seat was described as a significant encumbrance when loading litters and was least desired by the crew.

Blackout curtains were not available for our evaluations and the airworthiness release prevented us from using the white lights in the medical interior for medical care as directed in the MAST mission scenario. However, we found that the current NVG compatible lights in the prototype were satisfactory when performing medical procedures, including starting IVs, endotracheal intubation, checking wounds, and applying bandages. It was the collective opinion of the evaluators that the mission could be performed with NVG compatible lights. This adds the secondary benefits of allowing the crew to retain dark adaptation and perform clearing duties outside the aircraft with night vision goggles (since white light will degrade dark adaptation and require blackout curtains). Recommend additional research to determine if NVG compatible lighting will meet the operational mission requirements. Also, it is possible that white finger or lip lights, supplementing NVG compatible cabin lights, may be better than white light throughout the aircraft cabin.

Summary

The prototype UH-60Q aircraft is capable of performing the typical MEDEVAC missions described in the Materiel Need document. Flights flown for this effort included the first NVG flights, first external hoist operations, and first external cargo loading. The aviators described significant improvements in communication and navigation from the avionics enhancements in the aircraft.

The litter lift system should include a mechanical backup and improved positioning of litter straps. The center cabin crew seat was a signficant encumberance in loading litters. The Tencate (bubble) window produced distortion that was more noticable with NVG flights. There was inadequate storage space and nondevelopmental components of the medical interior require more durability and environmental protection. The operational requirements for crew communication and cabin lighting require additional study.

References

Bruckart, J. E. and Licina, J. R. 1993a. Technical evaluation of UH-60Q: Litter lift system and seating plan. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. USAARL number pending.

Bruckart, J. E. and Licina, J. R. 1993b. Performance demonstration: UH-60Q external rescue hoist and cargo loadmeter. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. USAARL number pending.

Bruckart, J. E., Licina, J. R., and Quattlebaum, M. D. 1993a. Technical evaluation of UH-60Q: Suction system. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. USAARL number pending.

Bruckart, J. E., Licina, J. R., and Quattlebaum, M. D. 1993b. Technical evaluation of UH-60Q: Medical Oxygen system. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. USAARL number pending.

Department of the Army. 1992. Appendix 1, UH-60A Black Hawk materiel need, production, dated 1979, (MN) (P) for Dustoff Black Hawk (UH-60Q).

Appendix A
Mission profile summaries

A. AEROMEDICAL EVACUATION (SOUTHWEST ASIA). The UH-60Q, collocated with a forward support medical company in direct support to a maneuver brigade, receives a mission to transport a trauma treatment team from the forward support medical company forward to a battalion aid station and then evacuate six litter patients and one ambulatory patient from the battalion aid station to the division clearing station located in the brigade support area (BSA). The UH-60Q departs the BSA with the trauma treatment team and flies at an airspeed of 120 knots using contour flight technique for 67 nautical miles (nm) and then slows to an airspeed of 30 knots using NOE flight technique for the last 3 nm to the battalion aid station. The trauma treatment team is off-loaded and the patients are loaded into the aircraft (20 minutes allocated for loading and unloading). The UH-60Q departs the battalion aid station using NOE for the first 3 nm and then transitions to contour flight for the remaining 67 nm to the BSA. The patients are off-loaded at division clearing station (10 minutes allocated) at which time the aircraft is ready for the next mission. Total time for the mission, to include patient loading and unloading times, is approximately 118 minutes.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	70	120/30	LL/NOE	44
Load patients			Landed	20
2-3	70	30/120	NOE/LL	44
Unload patients			Landed	10
TOTAL	140			118 (1.9 hr)

B. AEROMEDICAL EVACUATION (MAST). A UH-60Q located at a military installation receives a night MAST mission to transfer two patients involved in a traffic accident from a small community hospital to a medical center capable of providing life saving (definitive) medical treatment. The gaining hospital requests the mission and provides two nurses and a critical care physician to assist in the enroute care of the patients. The weather is marginal but acceptable. The small community does not have an airport or weather reporting capability and is not situated along the FAA enroute and terminal flight system. After pre-mission planning, the crew flies to the medical center (8 nm, 125 kts, low level) to pick up additional health care providers (5 minutes for loading). The crew uses onboard navigational equipment to locate and fly to the community hospital (80 nm, 120 to 145 kts, contour or low level). Unforecast weather was encountered at the pickup site. After landing, the health care team goes into the hospital to obtain patient briefings and execute transfer of patient responsibility (10 minutes for loading). The physician and the medic attend the adult patient while the nurses attend the baby. Once loaded, the crew departs for the medical center. The patients require constant enroute treatment and monitoring on the return flight. The health care providers must use

white light to provide appropriate care and must talk back and forth constantly. The female patient's condition deteriorates requiring the physician to contact the medical center to alert the operating room personnel of the requirement for immediate surgery upon arrival. Upon landing at the hospital helipad, the patients are off loaded (10 minutes) and moved into the hospital. The flight crew returns to the military installation (8 nm) and mission is complete. Total mission time is 2 hours.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	8	125	LL	5
Load personnel			Landed	5
2-3	80	120-145	LL	40
Load patients			Landed	10
3-4	80	145	LL	35
Offload patients			Landed	10
4-5	8	125	LL	5
TOTAL	176			120 (2 hr)

C. AEROMEDICAL EVACUATION (PERSIAN GULF). Low level flight for a distance of 200 nm with an airspeed of 110 to 120 kts. Hoist rescue from a hover of less than 70 feet (25 minutes allowed) followed by 170 nm low level flight at 110 to 120 nm. At this point the patients are offloaded and the aircraft flies 50 nm (low level) at an airspeed of 110 to 120 kts.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	200	110-120	LL	120
Rescue			Hover	25
2-3	170	110-120	LL	105
Unload patients			Landed	
3-4	50	110-120	LL	25
Offload patients			Landed	10
TOTAL	420+			275-305 (5.1 hr)

Adapted from Annex B, Appendix 1, UH-60A Black Hawk Materiel Need, Production, dated 1979 (MN) (P)

Appendix B.

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AVIATION AND TROOP COMMAND
4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

REPLY TO ATTENTION OF

29 OCT 1993 R-3
27 Jul 93 R-2
19 Feb 93 R-1
03 Feb 93

AMSAT-R-ECU (70-62b)

MEMORANDUM FOR

Commander, Tennessee Army National Guard, CECAT (Medical), 5900 Lovell Field Loop, Chattanooga, TN 37421
Commander, U.S. Army Aviation Aeromedical Research Laboratory, Human Protection Division, Fort Rucker, AL 36362
Project Manager, Utility Helicopters, ATTN: SFAE-AV-BH, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798

SUBJECT: Airworthiness Release (AWR) for UH-60A Serial Number (S/N) 86-24560, Configured as Proof of Principle Aircraft YUH-60A(Q), to Perform a Technical Evaluation of Typical Aeromedical Evacuation Missions R-3

1. References:

a. Technical Manual 55-1520-237-10(S), Draft Operator's Manual for UH-60Q Medevac Helicopter, 19 Jan 93, supplement to: Operator's Manual UH-60A and EH-60A Helicopters.

b. Technical Manual 55-1520-237-10, 8 Jan 88, with all changes, Operator's Manual, UH-60A and EH-60A Helicopters.

c. Technical Manual 55-1520-237-23, Headquarters, Department of the Army, 30 Sep 92, with all changes, subject: Aviation Unit and Intermediate Maintenance Manual for Army UH-60A and EH-60A Helicopters.

d. Drawing Number LEX-10000, Drawing Tree for Proof of Principle Aircraft "Q1", Jan 93.

e. Electromagnetic Compatibility (EMC) Safety of Flight (SOF) Test Plan for the UH-60Q Proof of Principle Medevac Helicopter, U.S. Army Aviation and Troop Command, Directorate for Engineering, January 1993.

f. Test Plan, U.S. Army Aviation Technical Test Center, STEAT-AQ-TC, January 1993, subject: Test Plan, Limited Qualitative Preliminary Airworthiness Evaluation of the UH-60Q Helicopter, Proof of Principle, TECOM Project Number 4-AI-170-UTT-123 (ATCOM Project No. 92-16).

g. Technical Manual 55-1520-237-MTF, Headquarters,

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03 Feb 93

AMSAT-R-ECU (70-62b)
SUBJECT: Airworthiness Release (AWR) for UH-60A Serial Number (S/N) 86-24560, Configured as Proof of Principle Aircraft YUH-60A(Q), to Perform a Technical Evaluation of Typical Aeromedical Evacuation Missions

Department of the Army, 13 Nov 90, Maintenance Test Flight Manual, UH-60A, UH-60L, EH-60A Helicopters.

h. Draft USAARL Report No. 93-XX, UH-60Q Test Plan, Oct 93,Technical Evaluation of UH-60Q Aircraft in Typical Aeromedical Evacuation Missions. R-3

2. This memorandum constitutes an Airworthiness Release in accordance with (IAW) Army Regulation (AR) 70-62 to perform a technical evaluation of typical Aeromedical evacuation missions with the UH-60A Helicopter S/N 86-24560 configured as YUH-60A(Q) Proof of Principle Aircraft. The technical evaluation shall be IAW reference 1h. R-3

3. The basic UH-60A/L helicopter is defined in reference 1b with exceptions as noted on the respective DD 250 acceptance document. Modifications to the aircraft are defined by reference 1d. A detailed description of the modified aircraft is contained in reference 1a.

4. Operations and Restrictions. The aircraft operating instructions, procedures, and limitations shall be IAW references 1a, 1b, and this document. In the event of a conflict between these documents, the information in this release shall prevail.

a. Use of the Night Vision Goggles (NVG) during this technical evaluation is authorized upon successful completion of a bar chart test IAW MIL-L-85762A prior to the first NVG flight. Use of the FLIR for night pilotage is not authorized. R-3

b. The aircraft shall be weighed and weight and balance data IAW paragraph 3.6.6 of MIL-W-25140B shall be prepared. The weight and balance file shall be updated IAW AR 95-3 following the instructions of Technical Manual 55-1500-342-23. A weight and balance form must be executed or on file for each flight per AR 96-16. Care must be taken with these forms in that the aircraft can be loaded outside the center of gravity (cg).

c. Avoid all published High Intensity Radio Transmission Areas (HIRTAs), TV towers, microwave towers, and other forms of high energy emitters by one half nautical mile, except as required by CONUS HIRTA message and during published approaches to normal aviation facilities. In HIRTA areas momentary

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AMSAT-R-ECU (70-62b)
SUBJECT: Airworthiness Release (AWR) for UH-60A Serial Number (S/N) 86-24560, Configured as Proof of Principle Aircraft YUH-60A(Q), to Perform a Technical Evaluation of Typical Aeromedical Evacuation Missions

disruption of communication, navigation and displayed information may occur, exit HIRTA area and attempt to recover equipment. R-3

d. Only the ARC-182 radios may be relied on for primary communications and only the very high frequency (VHF) omni-directional ranging (VOR) frequency/instrumented landing system (ILS) AN/ARN-147 and automatic directional finder (ADF) shall be relied upon for primary navigation.

CAUTION

The Enhanced Navigation System (ENS) and TACAN positions on the HSI/VSI mode select panel may be simultaneously engaged. TACAN will always have precedence and will be displayed on the number one needle on the HSI. R-3

CAUTION

The AN/ARN-147 VOR receiver does not provide input to the course deviation indicator (CDI); therefore, the number two needle on the remote magnetic indicating compass (RMI) shall be used when tracking VOR radials. The CDI does function normally when in the TACAN or ILS mode.

NOTE

The ARC-182 radios shall not be relied upon for Frequency Modulation communications.

e. Voice Altitude Warning System (VAWS) AL-9003-11.

WARNING

Do not rely on the voice feature of the VAWS for terrain avoidance because the VAWS does not "look-ahead" of the aircraft. The VAWS is to be used during Visual Flight Rules (VFR) operations only.

f. TACAN TCN-500 Navigation System.

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03 Feb 93

AMSAT-R-ECU (70-62b)
SUBJECT: Airworthiness Release (AWR) for UH-60A Serial Number (S/N) 86-24560, Configured as Proof of Principle Aircraft YUH-60A(Q), to Perform a Technical Evaluation of Typical Aeromedical Evacuation Missions

WARNING

A minimum personnel stand-off distance of 30 inches from the TACAN antenna shall be maintained whenever the TACAN is transmitting.

g. HF-9000 High Frequency Communications System.

WARNING

The HF-9000 system contains a radio frequency transmitter which, when operated into an antenna, may produce electromagnetic fields in close proximity to the antenna that are in excess of Occupational Safety and Health Administration (OSHA) recommended maximum limits. A minimum personnel standoff distance of 10 feet shall be maintained.

WARNING

Be sure all personnel are clear of HF antenna when performing radio checks. Do not touch the RF output terminal on the antenna coupler, the antenna lead-in wire, the insulated feed through, or the antenna itself when the microphone is keyed (after the tuning cycle is complete) or while the system is in transmit self-test. Serious RF burns can result from direct contact with the above items when the system is transmitting.

h. Medical Interior Package. Use of the medical attendant seats and litter stations is authorized for this technical evaluation. The appropriate restraints shall be used at all times when occupying these positions. R-3

WARNING

Close proximity of the medical attendants seats to adjacent seats, litters, and cabinets poses as a strike hazard to the occupants in the event of a

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crash. All occupants shall wear SPH4 helmets and restrain themselves with both the lap belts and shoulder harnesses.

The ECU Air Conditioner/Heater, Oxygen Generation System, and Litter Lift System is prohibited from use during flight. The circuit breakers for this equipment shall be pulled and tie wrapped.

i. The Breeze Eastern and Lucas Western External Hoists are authorized to be installed and operated.

WARNING

Use of the external hoist with any living entity is prohibited.

j. The Altitude Hover Hold System has been removed from the aircraft.

k. Use of the cargo hook/cargo hook weighing system is authorized for this technical evaluation. R-3

l. Use of the SABRE communication system is prohibited during flight.

m. Use of the ARC-210 Multi-band radio is prohibited during flight.

n. Use of the Flight Phone is prohibited during flight.

o. Use of the KG-10 Map Board is prohibited during flight.

p. Use of the Personnel Locating System (PLS) is prohibited during flight.

q. Information obtained from the RDR-1301C Weather Radar, WX1000+ Stormscope, and TACAN shall not be relied upon.

r. Aircraft bank angles.

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NOTE

At bank angles of approximately 55 degrees a roll oscillation will be experienced. This has been detected at 70 and 100 knots.

s. Use of the Blade De-ice systems is prohibited.

t. Use of the Digital Heading Indicators is prohibited.

u. The maximum gross weight shall be 22,000 pounds provided the wedge mounted pitot static probes are installed and the number one and number two Engine Drive Shafts are balanced at or below 0.5 inch per second.

v. Use of the PhysioControl LifePak 6S or LifePak 10 and ohio Infant Transport Incubator is authorized provided the following is performed. An EMC test shall be performed and successfully competed prior to the first flight to ensure that the operation of these components does not adversely affect the operation of the aircraft. The EMC test shall include, as a minimum, all frequencies that will be used throughout this portion of the flight test. R-3

5. Special Inspections and Instructions:

a. Equipment shall not be changed without first contacting this Headquarters, U.S. Army Aviation and Troop Command (ATCOM), ATTN: AMSAT-R-ECU, Mr. William Brooks, DSN 693-1687 or commercial (314) 263-1687. This does not include the replacement of a component with the identical component (i.e. for component repair). An equipment change will require a qualitative Electromagnetic Compatibility (EMC) test IAW reference 1e, and shall be conducted and approved by this Headquarters prior to first flight of the newly installed equipment to demonstrate that the newly installed equipment (including any test instrumentation) does not serve as sources or victims of electromagnetic interference with existing electrical/electronic subsystems.

b. Any EMC anomalies shall be reported by phone to Headquarters, ATCOM, ATTN: AMSAT-R-ECU, DSN 693-1687 or commercial (314) 263-1687, prior to next flight.

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c. A daily visual inspection shall be made of the subject installation to ensure that no progressive structural deterioration is occurring, that there is no loss of security and that no damage to the host helicopter exists. Any occurrence of the preceding shall be corrected prior to further flight operations.

d. Parts needed for this modification are not available in the supply system. Your activity facility must locally procure/manufacture the modification parts (plus any additional spare parts). This AWR is not authorization to procure any material or services "Sole Source."

e. In the event any operating limit, or limits established by this release is exceeded in addition to the normal entry on DD Form 2408-13, appropriate inspection plus special inspection for security and condition of modifications shall be performed prior to next flight. Any incident or malfunction of the aircraft suspected of being related to these configuration modifications shall be reported immediately to this Headquarters, ATTN: AMSAT-R-ECU, Mr. William Brooks, DSN 693-1687 or commercial (314) 263-1687.

f. The aircraft shall be maintained IAW all applicable Maintenance Manuals and Associated Maintenance Advisory and Safety of Flight Messages. Any discrepancies shall be evaluated/repaired prior to the next flight to ensure continued airworthiness of the helicopter.

g. Prior to flight after any modifications a Maintenance Test Flight (MTF) shall be conducted IAW reference 1g with modifications as required for the YUH-60A(Q) Proof of Principle aircraft.

h. Designation of Aircraft UH-60A S/N 86-24560 as YUH-60A(Q) shall be performed by annotating DA Form 2408-15 and submitting DA Form 1352 to reflect this aircraft as a YUH-60A(Q).

6. Aircraft Logbook Entries.

a. Logbook entries shall be made IAW Department of the Army Pamphlet 738-751.

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b. The DA Form 2408-13 shall be annotated IAW this Airworthiness Release as follows:

Block 16	Block 17
circle red "X"	Aircraft Restricted IAW Airworthiness Release

c. The above test flight entry shall be cleared upon completion of the test. The other above entry shall be cleared upon return of aircraft to standard configuration. It is acceptable for the local Commander or maintenance officer to assume responsibility for the above daily inspection entry by means other than the logbook entry.

d. Block 7 shall be adjusted when appropriate.

e. A copy of this AWR shall be placed in the helicopter logbook and historical records. The DA Form 2408-15 shall be annotated to indicate the issuance of this Airworthiness Release.

7. This AWR is terminated upon changes is hardware or software configuration of any equipment, upon issuance of a later Airworthiness Release or completion of the technical evaluation. R-3

DANIEL M. McENANY
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Appendix C.
Comments on medical interior systems for Southwest Asia missions.

Litter lift system

Day: Less (but not much) physical effort than current system.
System is slow and continually needs to be reset or manually overridden.
System too slow, manual can be done quicker.
Night: Power berths made it easy to move patients to a provery location.
Very limited clearance.
Areas for working on a full load of litter patients was difficult.

Medical suction system

Day: None.
Night: Having suction available is always a great advantage.
You must ensure all hoses are free from the litter racks.

Medical oxygen system (no comments).

Tencate window

Day: I can look up and down better than in regular system.
I personally feel that it caused me some mild motion-related nausea due to the distortion.
Night: We can look up and down better.

Communications system

Day: The VOX and PVT options are much needed additions. They allow hands-off commo.
Night: Not enough connections for each crew member to communicate.
Need a 2-way commo system.

Crashworthy crew seating

Day: Awkward to move around. The center seat was constantly in the way.
More comfortable, can rotate.
Night: More comfortable.

Overall comments

Day: I personally did not like the marginal room afforded me for patient care (6 patients loaded).

The patient securing straps were often hard to find and in many cases too short.

The center seat (I feel) should be removed. It was constantly in the way during loading, and was unable to be swiveled when patients were loaded. (possibly reduce the width of the seat, and extend tracks on floor all the way to the front?)

I felt confined in my seat, as I was unable to set up without unstrapping my seat belt.

Suggestions:

Cut patient load in front to 4.

Devise a "reel" system for patient securing straps (much like on existing carousel).

Again, reduce width of center seat and extend floor tracks all the way to the front, or better yet, remove it all together.

Install Gunner's Harnesses (inertia reels) on seats (much like on existing UH-60A).

Not enough space for maneuvering

Hard to unload and load litters.

Middle seat gets in the way.

Night: The system seems better than others, but can use some improvements:

Communication - made available to all crew members.

Litter system - situated better, to make load and unload of patients better.

Litter lift: If it gets stuck we have to look for the reason and it slows us down. The way it is placed, it makes it harder to put litter patients in.

The jump seat for the medic cannot do a 360 in the patient care area and the track for the seat needs to extend all the way to the pilot seat. Given a little more space on the ends will allow the medic to use the ends to change directions, and use the seat to perform patient care.

Communication would make a great difference if there were a system that would allow the medics to communicate with each other and the medic in charge could communicate with the crew in the patient compartment and the pilots when needed.

Appendix D.
Comments on medical interior systems for MAST missions.

Litter lift system

Day: Sometimes it took too long loading due to the lift system, still need more practice securing the patient is a problem the straps are difficult to find when patient is loaded.
Unable to test in flight.
Control systems not easily understandable
Tight right angle turn to slide in patient, but managable.
Night: We have to wait for the system to go up or down, is slow.
The middle seat gets in the way.

Medical suction system

Day: Hands on use easy, but controls not adjustable with gloves.
Night: None.

Medical oxygen system

Day: Need portable O2 for Tx on scene.
Need color coded hook ups - for example Green = O2.
Night: None.

Tencate window

Day: Easier to clear tail, with gunner's window it was just as easy.
Some distortion around edges.
Slight visual distortion.
Night: None.

Communications system

Day: The private is a big advantage.
Unable to adjust with gloves.
Stepping on cockpit crew commo / nav - ATC commo heard.
Night: The one by the front is not working.

Crashworthy crew seating

Day: Medic and crewchief are able to sit in direction of flight instead of sideways look out the gunner window.
Unable to get out of my seat and still be secure in A/C while Tx Pt.
Cords tangle in seat.
5-point restraint.

Night: More comfortable than current seating, also seatbelt system easier to handle.

Overall comments

Day: Functioning as the nurse on this MAST mission, due to my position L rear seat, I was unable to give any vital patient care.
Limit crew to 4 in the rear.
Like to see commo between radios / cockpit crew limited to lets say the crewchief only. If the crew is overloaded (bad weather) and the medico's are overloaded (bad patient) commo grinds to an aggravating slow and confusing pace.

Night: None.

Appendix E.

Aviator comments on avionics and communications equipment used in missions.

Communication system

Avionics management system is fully NVG compatible, unlike current radio control heads which are unlit.

Easy frequency selection through presets.

Indentification of preset and station name on cockpit display unit.

Manual programming of frequencies during IFR hand-off was simplified by cockpit display unit selecting frequency band appropriate to frequency selected. i.e. UHF vs. VHF.

This was only my second flight in the UH60Q. I was still pressing some keys in the wrong sequence, but the displays allowed me to quickly identify my mistakes and easily correct them.

All radios centrally located and easy to access.

Navigation system

Addition of INS weight is negligible, but benefits in case of GPS outage. This system constantly displays wind speed and direction, current system does not.

GPS information is lacking from current system (i.e., status of satellites, figure of merit value).

ILS/ADF no change from current system.

Enroute navigation system (ENS) - ability to program nonconsecutive waypoints into a flight mission and automatic switch over to next waypoint in flight plan when passing over the waypoints significantly reduced workload during the flight. The accuracy of each component of the ENS was much better than the current AN/ASN-28 Doppler, data entry is much easier with the cockpit display unit / cockpit management system.

Time to go to waypoint provided an excellent means of determining arrival times throughout the mission. This feature is useful for both pilotage and mission execution as well as quickly notifying supporting medical treatment facilities of ETAs and mission progress.

All integrated into a single package.

INS requires 8 minutes for full alignment.

FLIR system

Allows detection of FLIR compatible targets at greater range than ANVIS.

Able to detect / identify at much greater ranges than ANVIS.

Excellent for locating personnel / vehicles or avoiding same.

Multifunction displays (MFD)

Provide singular instrument viewing of crucial systems (i.e., torque / TGT) while providing wind drift compensated course guidance to selected destination.

Can view FLIR & Wx radar.

It would be nice to have a constant / current TGT value rather than TGT value when MFD function selected.

Provides a single instrument display of all flight instrument data in an easily recognizable format.

There is currently a calibration effor in the barometric altimeter digital display. This did not cause any problems in the flight.

Weather radar and Stormscope

The combination of the two allow excellent adverse weather avoidance ability.

Overall Comments

UH60Q provides all weather MEDEVAC capability.

Would be nice to see this on an "L" model UH60 instead of "A" model.

I was very impressed with the Canadian Marconi Cockpit Display Unit / 1553 Databus Controller. The software development for the data input sequences are very logical and easily learned. The displays are easily readable and provide superior information (than) existing systems.

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